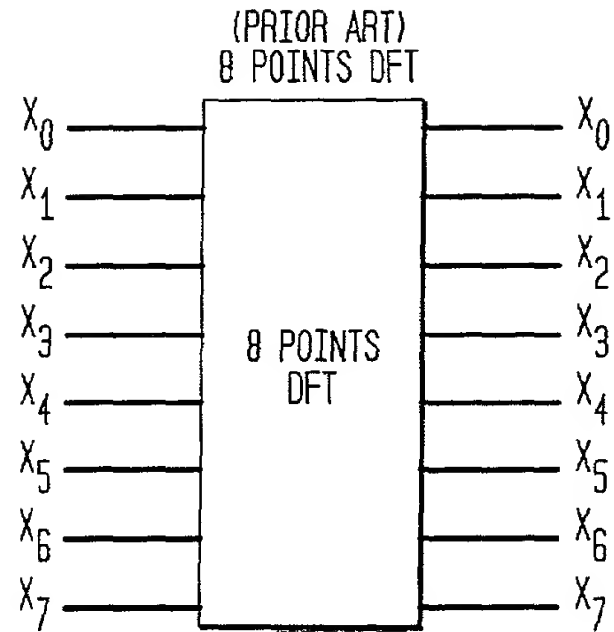(PRIOR ART)
8 POINTS DFT

Fig 1A

(PRIOR ART)
8 POINTS DFT OBTAINED BY COMBINING TWO FOUR POINTS DFT

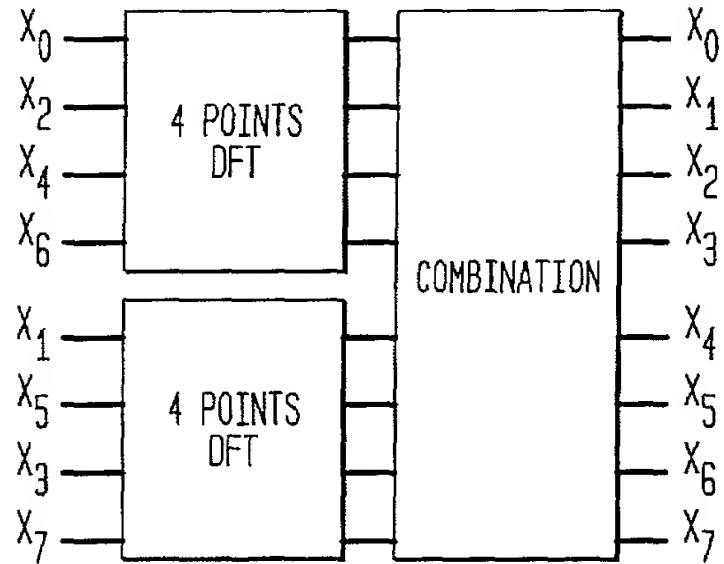Fig 1B

(PRIOR ART)
8 POINTS DFT OBTAINED BY COMBINING FOUR TWO POINTS DFT
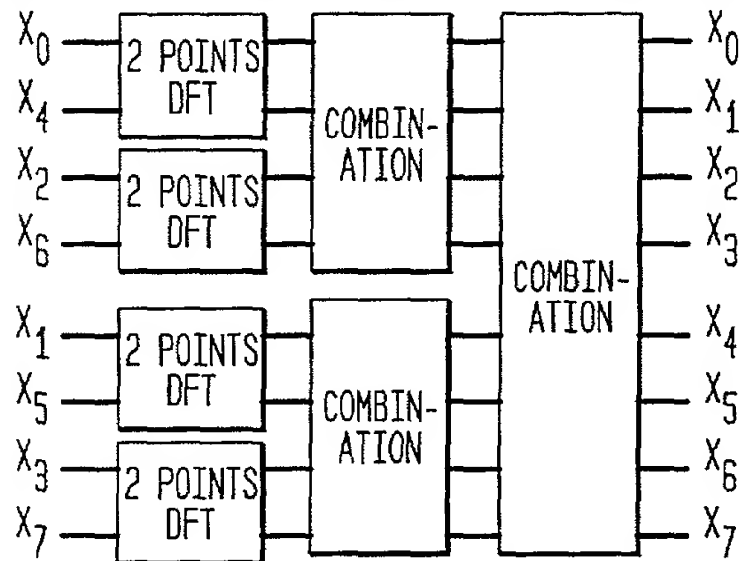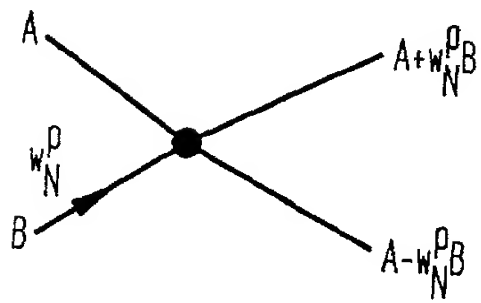
Fig 1C

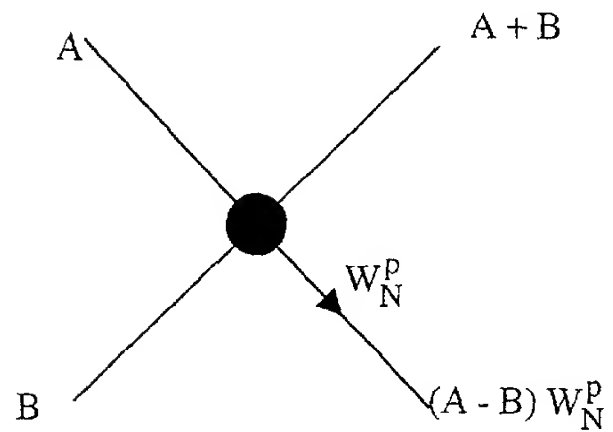DIT RADIX-2 BUTTERFLY COMPUTATION

DIF RADIX-2 BUTTERFLY COMPUTATION

Fig 2A1

Fig 2A2

BUTTERFLIES REPRESENTATION OF AN 8 POINTS FFT

Fig 2B

FIG. 2C
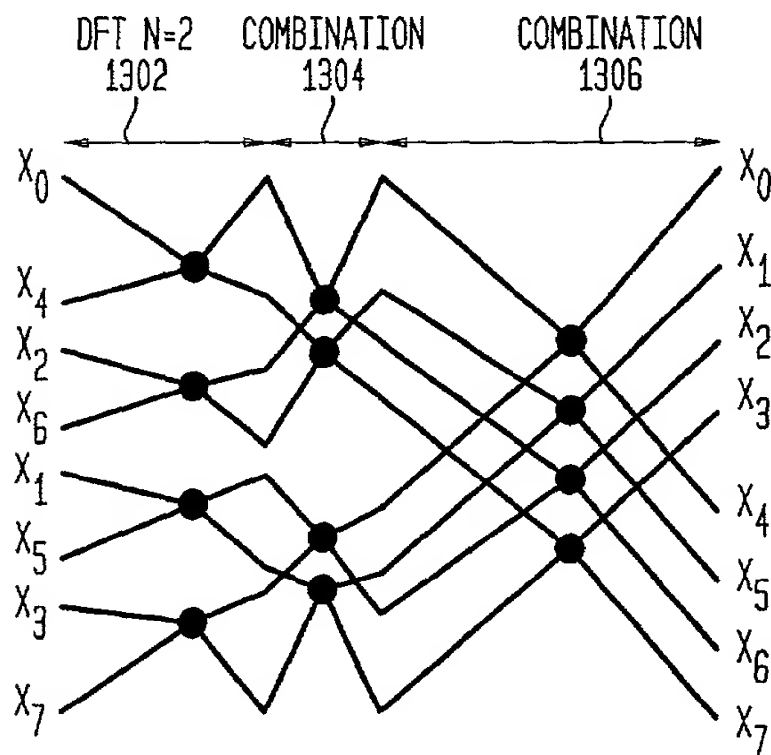
IN PLACE FFT WITH BIT REVERSED INPUTS AND NORMALLY ORDERED OUTPUTS (r=2)

FIG. 2D
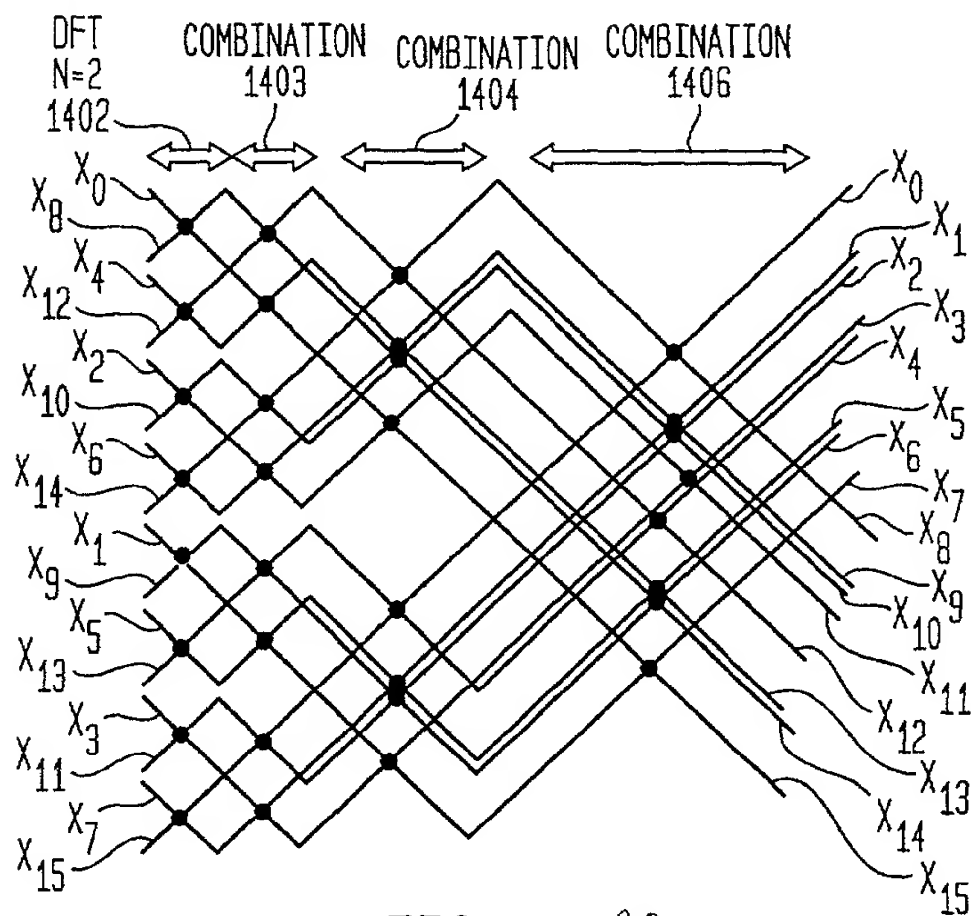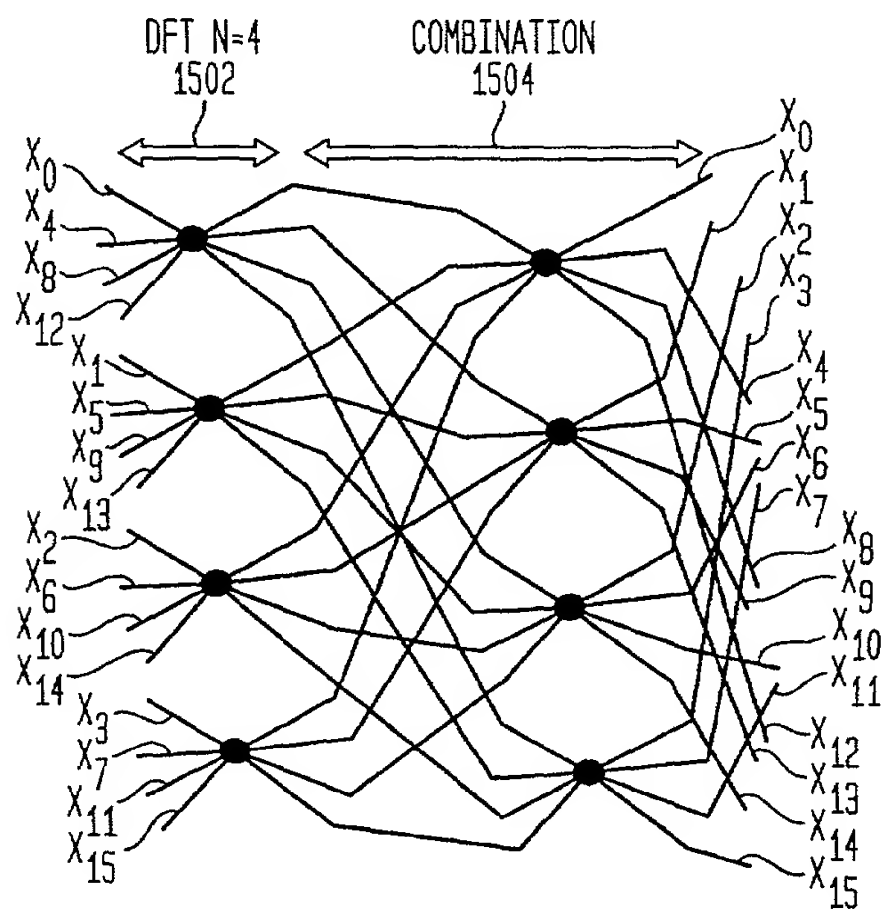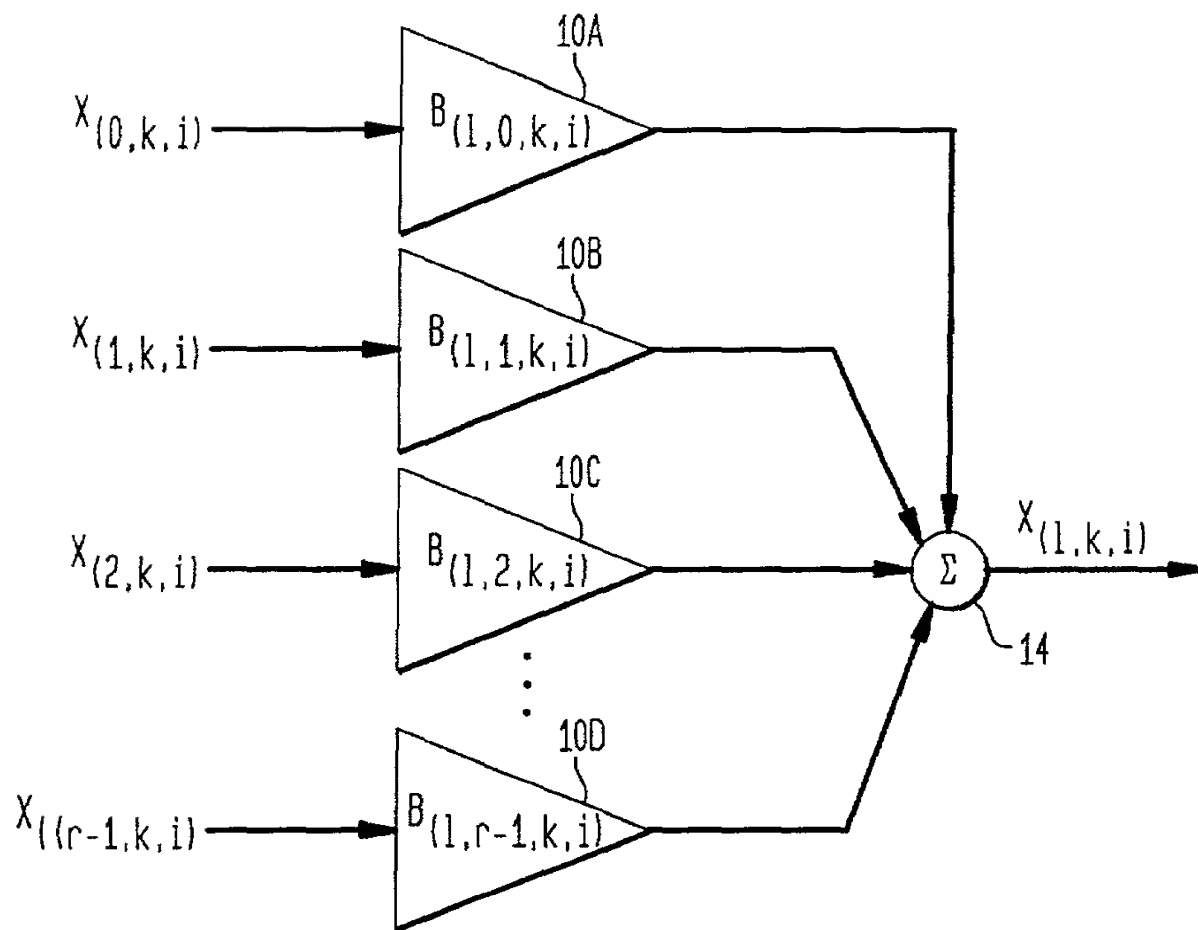
IN PLACE FFT WITH BIT REVERSED INPUTS AND NORMALLY ORDERED OUTPUTS

FIG. 3A
JABER'S RADIX-r DIF ENGINE

$X_{(0,k,i)} \rightarrow$ $B_{(1,0,k,i)}$ 10A

$X_{(1,k,i)} \rightarrow$ $B_{(1,1,k,i)}$ 10B

$X_{(2,k,i)} \rightarrow$ $B_{(1,2,k,i)}$ 10C

$X_{((r-1,k,i)} \rightarrow$ $B_{(1,r-1,k,i)}$ 10D

Σ 14 $\rightarrow X_{(1,k,i)}$

FIG. 3B
SIMPLIFIED JABER'S RADIX-r DIF ENGINE
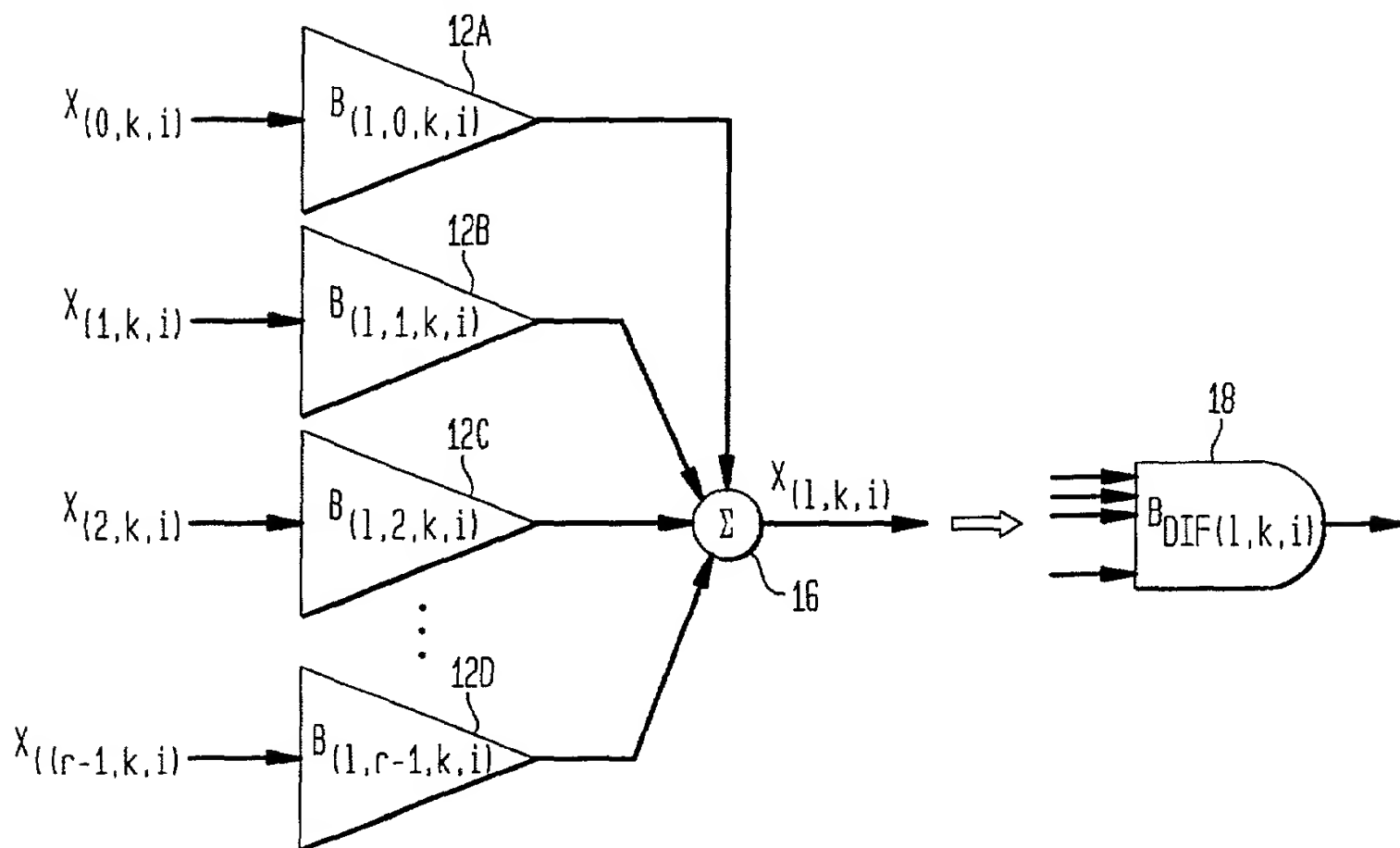
$X_{(0,k,i)} \rightarrow$ $B_{(1,0,k,i)}$ 12A

$X_{(1,k,i)} \rightarrow$ $B_{(1,1,k,i)}$ 12B

$X_{(2,k,i)} \rightarrow$ $B_{(1,2,k,i)}$ 12C

$X_{((r-1,k,i)} \rightarrow$ $B_{(1,r-1,k,i)}$ 12D

Σ 16 $X_{(1,k,i)} \rightarrow$

$\Rightarrow$ 18 $B_{DIF(1,k,i)} \rightarrow$

FIG. 4A
JABER'S RADIX-r DIT ENGINE

$X_{(0,k,i)}$

$X_{(1,k,i)}$ ⟶ $B_{(1,1,k,i)}$ 20A

$X_{(2,k,i)}$ ⟶ $B_{(1,2,k,i)}$ 20B

$X_{((r-1,k,i)}$ ⟶ $B_{(1,r-1,k,i)}$ 20C

Σ 24 ⟶ $X_{(1,k,i)}$

FIG. 4B
SIMPLIFIED JABER'S RADIX-r DIT ENGINE

$X_{(0,k,i)}$

$X_{(1,k,i)}$ ⟶ $B_{(1,1,k,i)}$ 22A

$X_{(2,k,i)}$ ⟶ $B_{(1,2,k,i)}$ 22B

$X_{((r-1,k,i)}$ ⟶ $B_{(1,r-1,k,i)}$ 22C

Σ 26 ⟶ $X_{(1,k,i)}$ ⟹ $B_{DIT(1,k,i)}$ 18
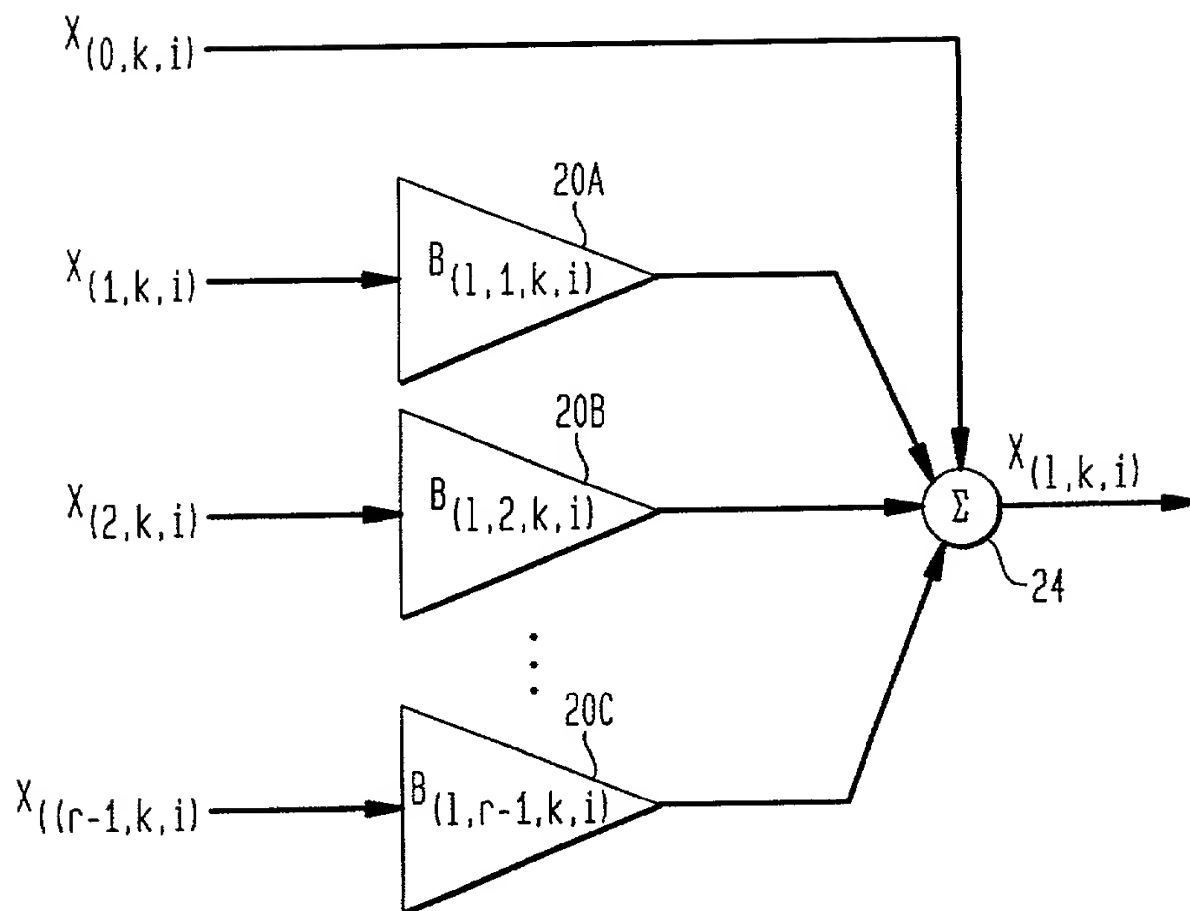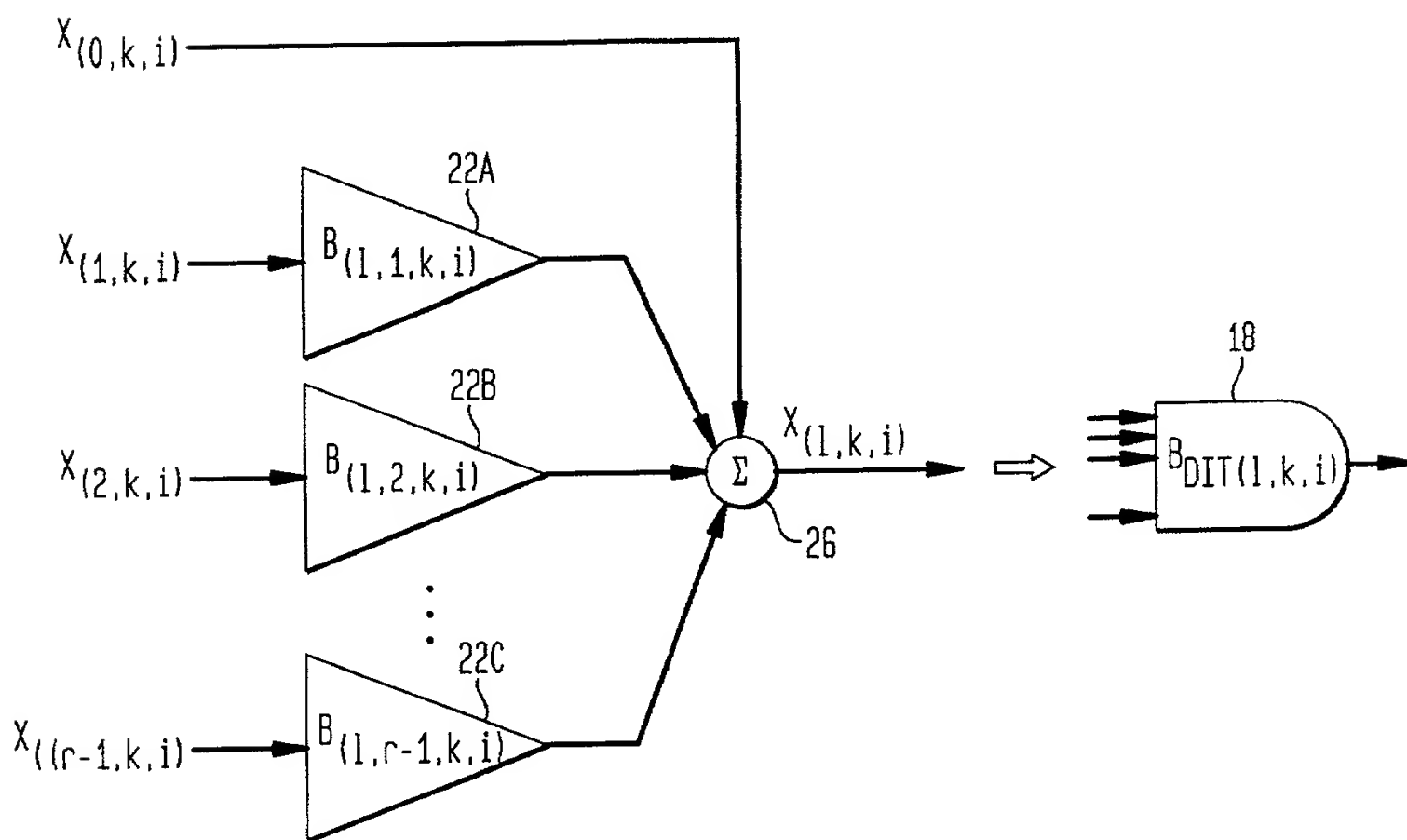
FIG. 5A
JABER'S RADIX-r DIF MODULE

$X_{(0,k,i)}$
$X_{(1,k,i)}$
$X_{(2,k,i)}$

$X_{((r-1,k,i)}$

30A
$B_{DIT(I,k,i)}$ → $X_{(0,k,i)}$

30B
$B_{DIT(1,k,i)}$ → $X_{(1,k,i)}$

30C
$B_{DIT(1,k,i)}$ → $X_{((r-1,k,i)}$
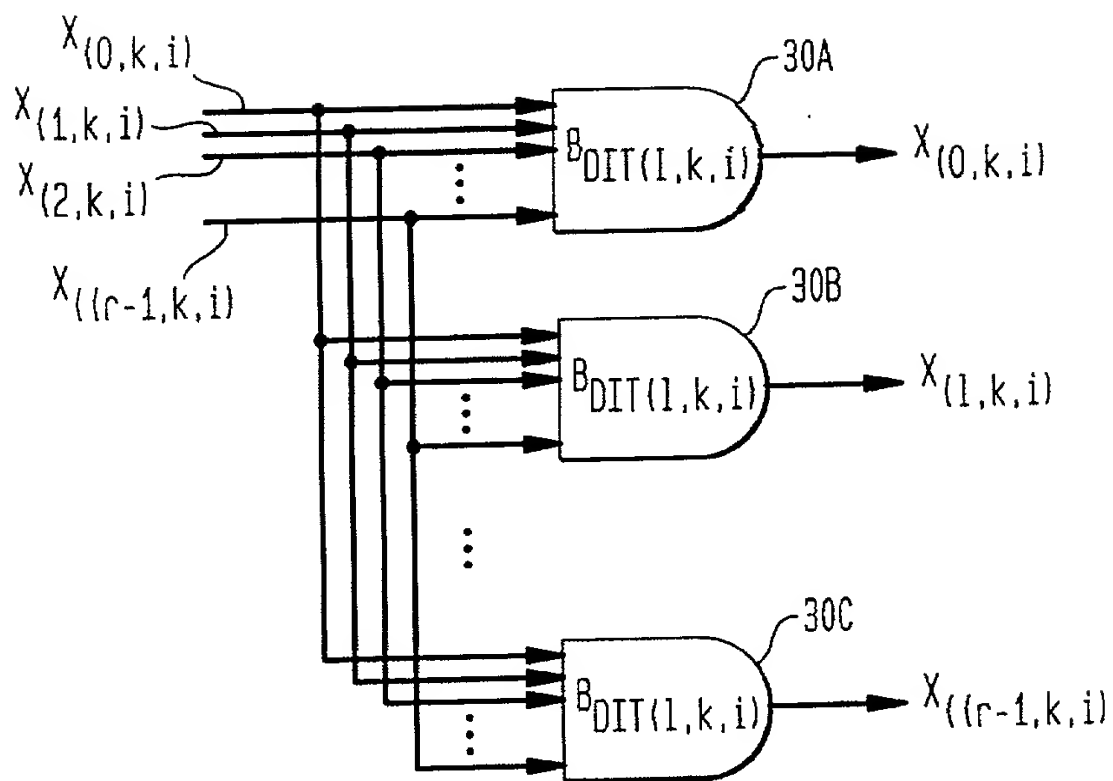
FIG. 5B
JABER'S RADIX-r DIT MODULE

$X_{(0,k,i)}$
$X_{(1,k,i)}$
$X_{(2,k,i)}$

$X_{((r-1,k,i)}$

34
Σ → $X_{(0,k,i)}$

32A
$B_{DIF(1,k,i)}$ → $X_{(1,k,i)}$

32B
$B_{DIF(1,k,i)}$ → $X_{((r-1,k,i)}$
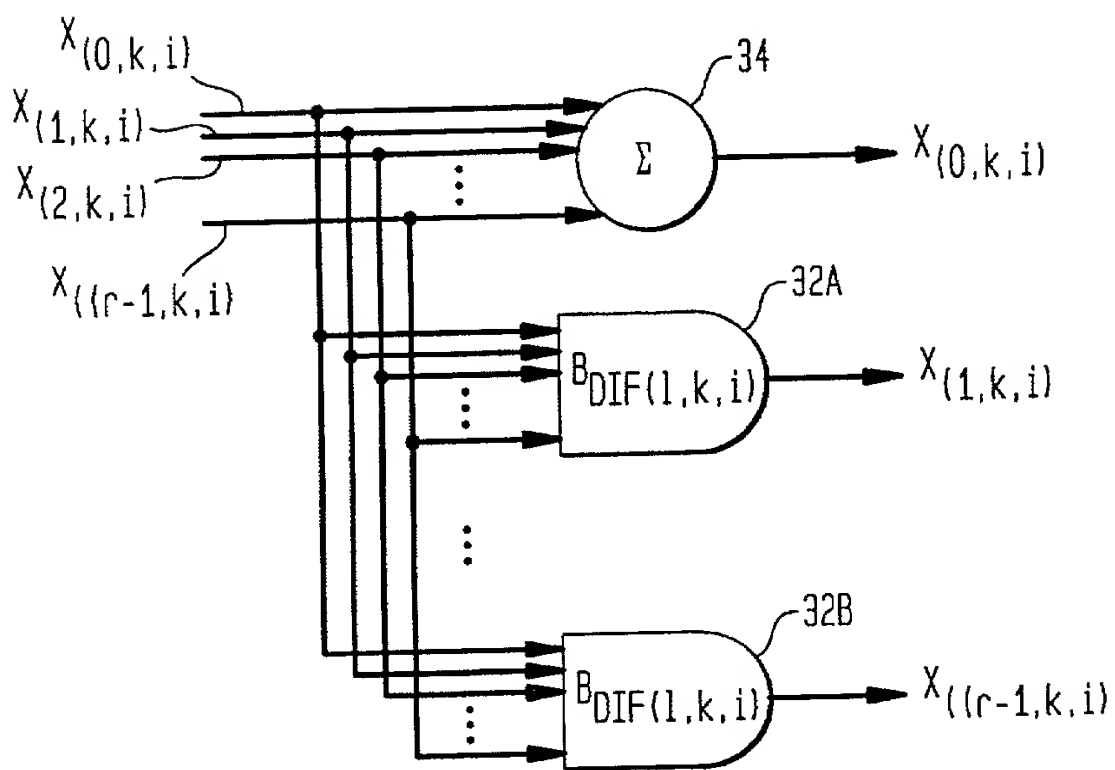
FIG. 6A
RADIX-8 DIT FFT ENGINE

PHASE 1　PHASE 2　　PHASE 3　　PHASE 4
40　　　42　　　　44　　　　46

48

49
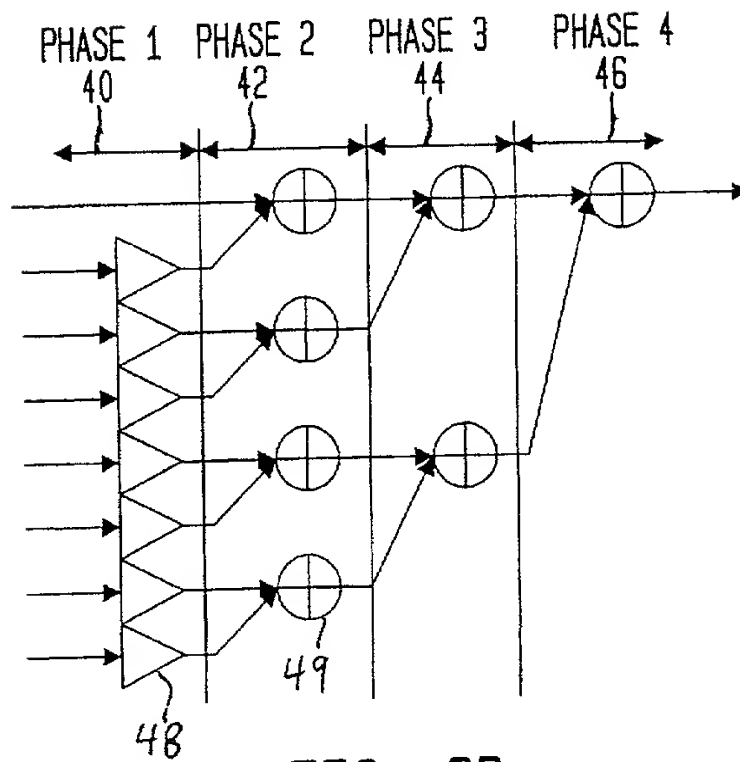
FIG. 6B
RADIX-16 DIF FFT ENGINE

PHASE 1　PHASE 2　　PHASE 3　　PHASE 4　　PHASE 5
50　　　52　　　　54　　　　56　　　　60

58

59

S_{200}

S_{210}

$S_{2(r-1)0}$

S_{10}

S_{201}

S_{11}

S_{211}

S_0

$S_{1(r-1)}$

$S_{2(r-1)1}$

$S_{20(r-1)}$

$S_{21(r-1)}$

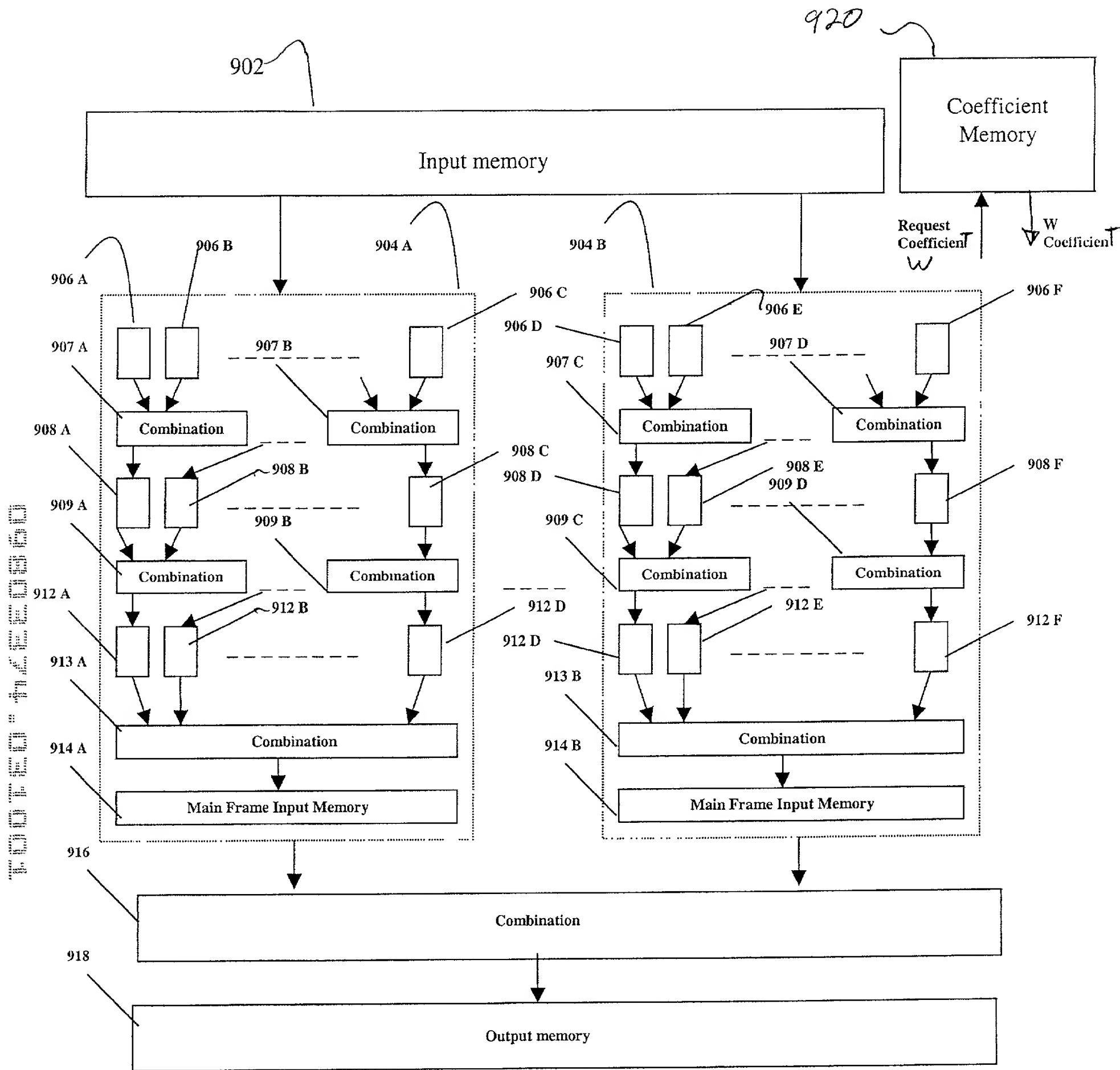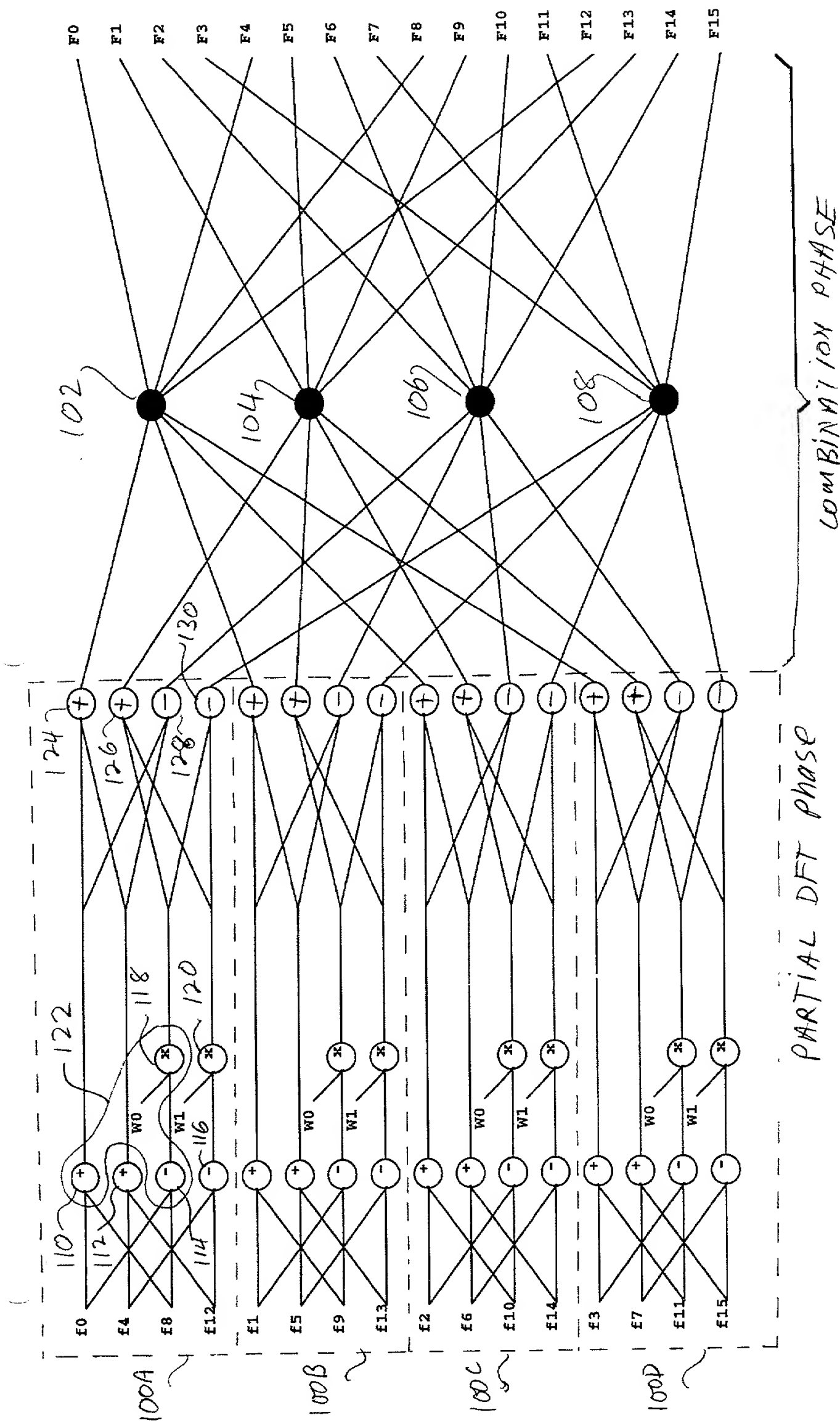$S_{2(r-1)(r-1)}$

Fig 7

Fig 8

Fig 9

COMBINATION PHASE

PARTIAL DFT PHASE
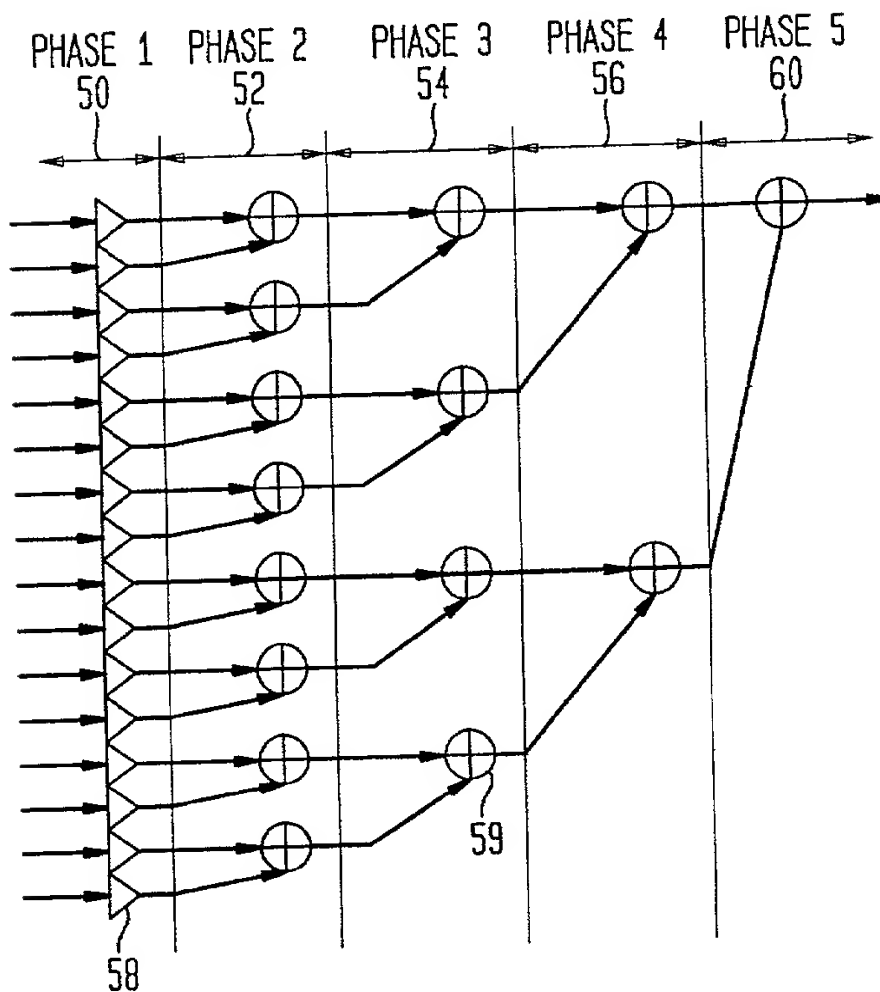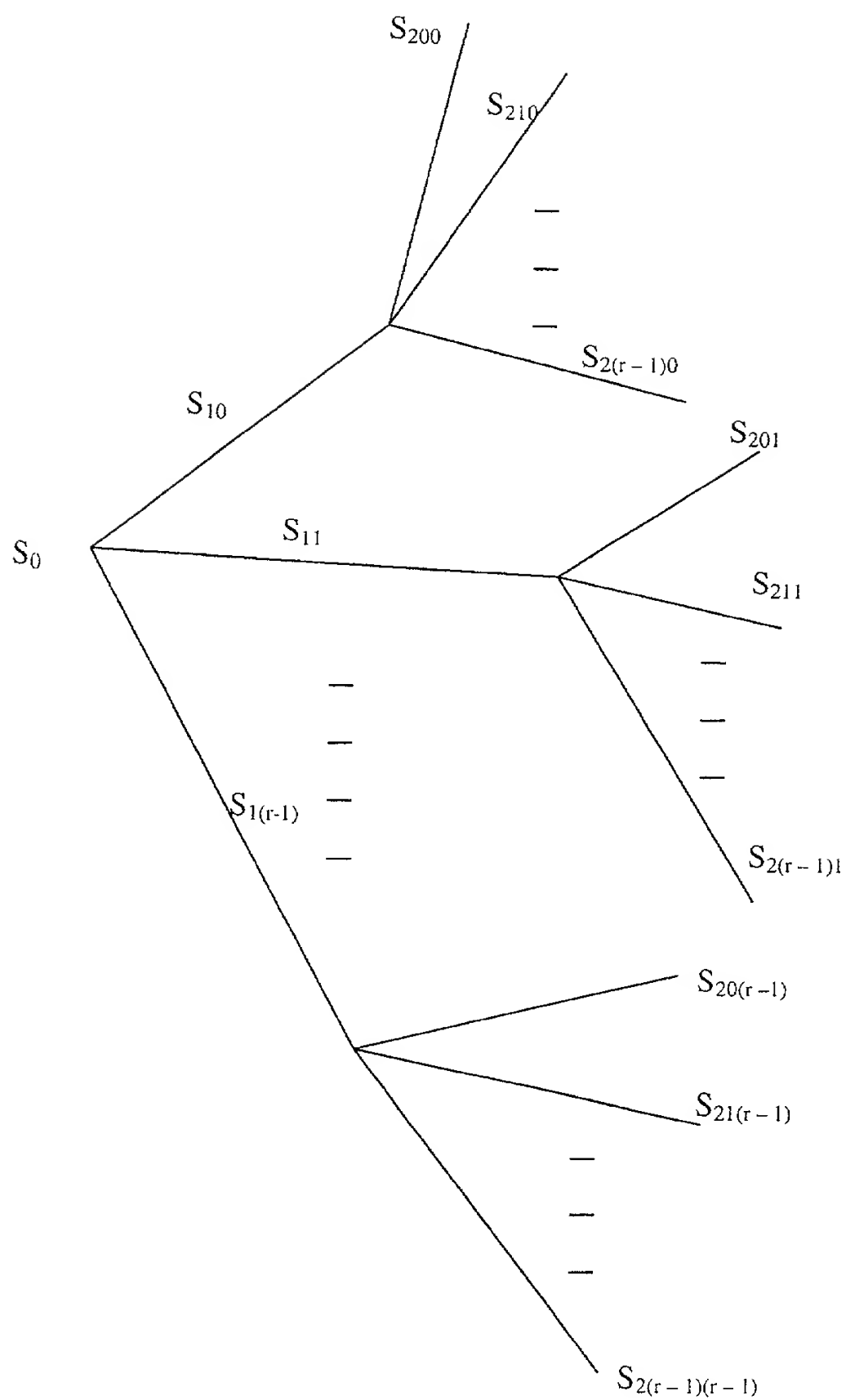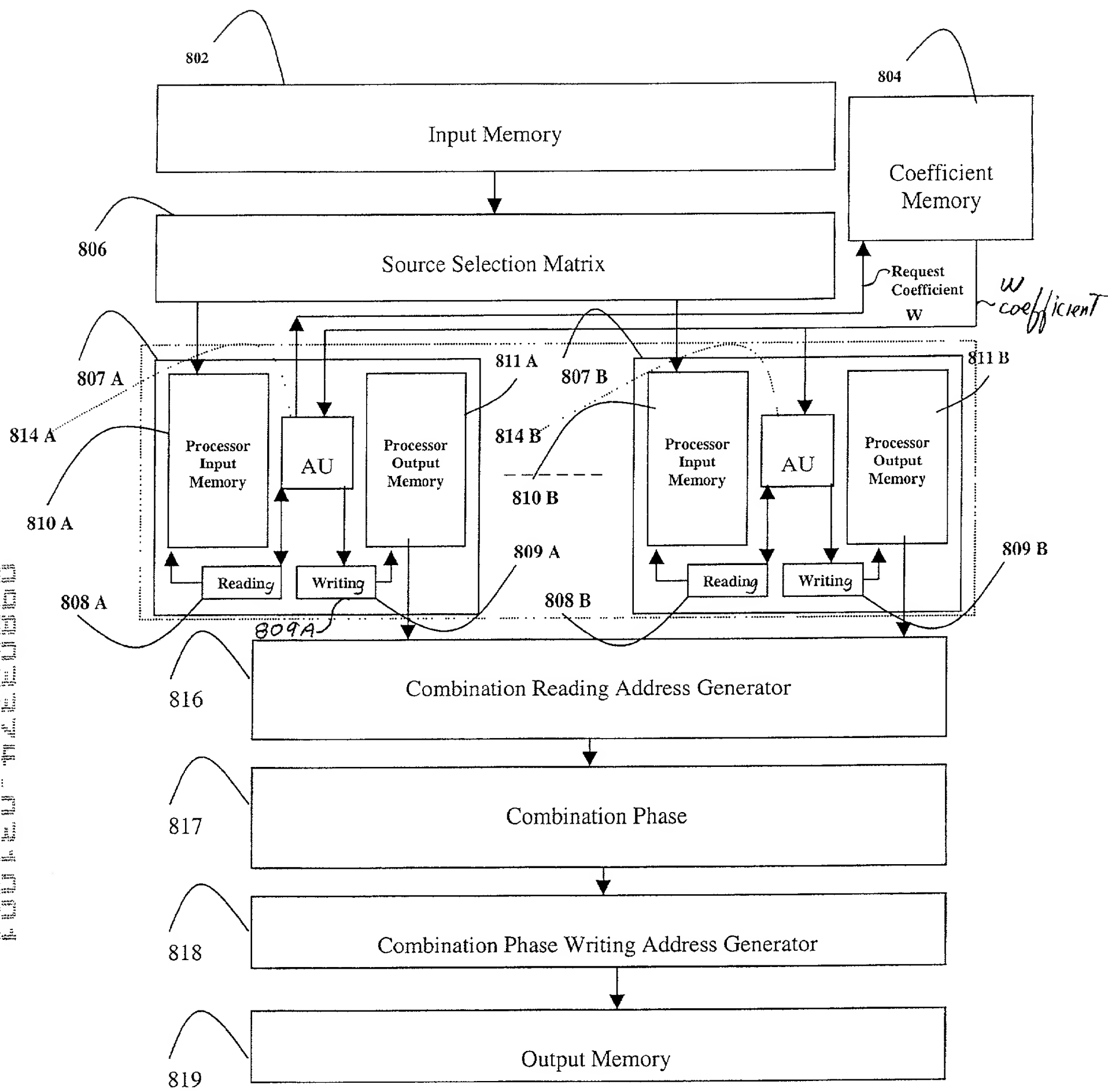
FIG 10

16 Points FFT radix 2 on four parallel processors with combination phase

F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 F10 F11 F12 F13 F14 F15

f0 f4 f8 f12 f1 f5 f9 f13 f2 f6 f10 f14 f3 f7 f11 f15

W0 W1 W0 W1 W0 W1 W0 W1

100A 100B 100C 100D

102 104 106 108

110 112 114 116 118 120 122 124 126 128 130

16 POINTS FFT MAPPING
WITH COMBINATION PHASE

FIG 11